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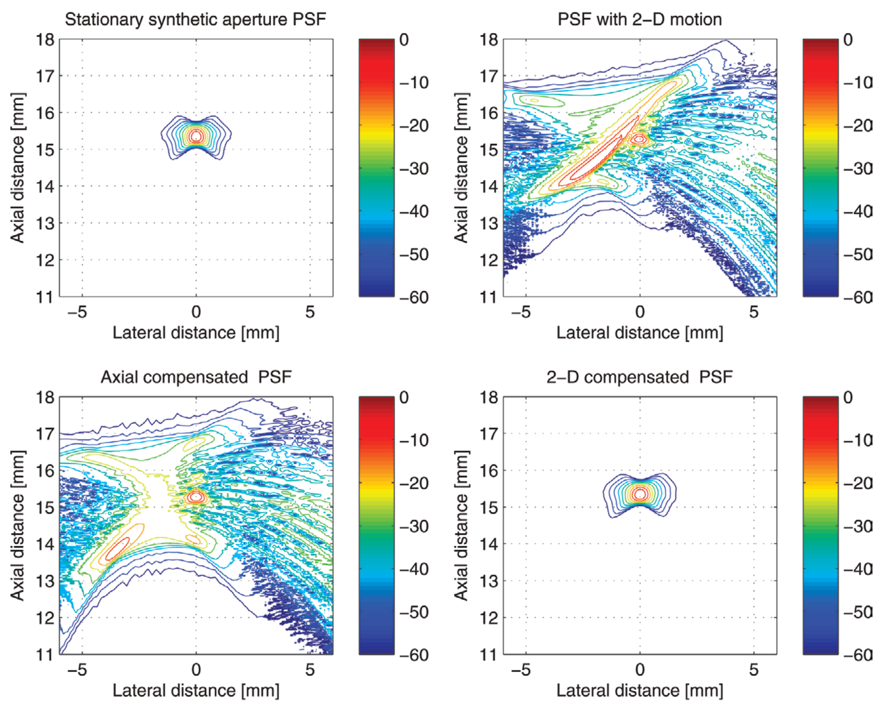

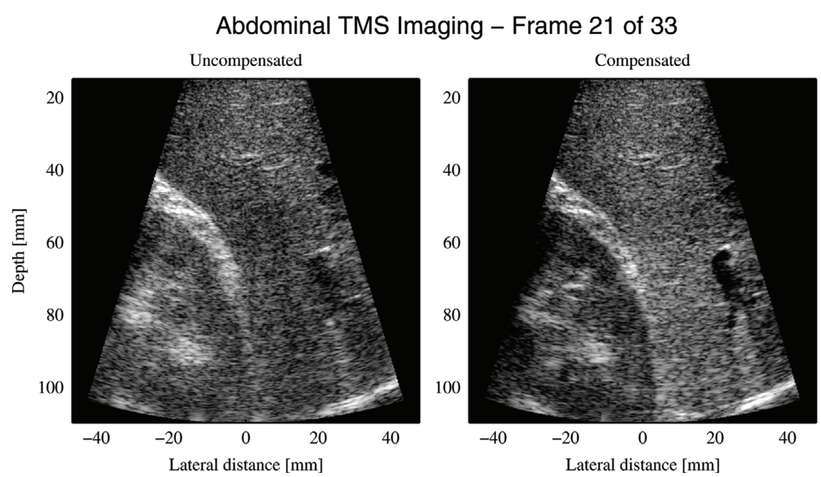

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2-D Tissue Motion Compensation of Synthetic Transmit Aperture Images

The accompanying paper describes a new method for reducing motion artifacts in synthetic aperture (SA) images. These are acquired over a number of pulse emissions and then focused by combining the received signals for all emissions. The acquisition time for the imaging lines is therefore longer than for traditional images, and this can lead to defocusing effects from tissue motion. SA images often have a high resolution, on the order of a wavelength both axially and laterally, and tissue motion in either direction thus affects the image quality. This is illustrated in the top four graphs on the front cover, which depict the point spread function (PSF) from a linear-array SA imaging system with 128 emissions acquired at a 5 kHz pulse repetition frequency. The top-left graph shows the ideal PSF and the right graph illustrates the PSF for a tissue velocity of $(v_{\mathrm{axial}}, v_{\mathrm{lateral}}) = (10.6, 10.6)$ cm/s. Employing a purely axial motion compensation gives the PSF on the lower left, which still has significant distortion of the side lobes. Employing a 2-D motion compensation yields the PSF shown on the lower right, where the ideal PSF is nearly recovered.

A duplex SA imaging scheme with 2-D motion estimation was developed in the accompanying paper and employed in the grayscale *in vivo* images shown at the bottom. They show a longitudinal section of the right liver lobe with a cross-sectional view of the hepatic vein (right), longitudinal section of a portal vein branch (top center), the kidney, and diaphragm at the lower-right corner. The left image is without compensation and the right has been compensated using the new 2-D approach. A clear improvement can be seen for the hepatic vein and the boundary of the kidney. A video sequence ( ) is included in the web version of the paper. For further reading, please see the accompanying article on page 594 of this issue.

Images courtesy of Kim Løkke Gammelmark and Jørgen Arendt Jensen. K. L. Gammelmark was with and J. A. Jensen is with the Center for Fast Ultrasound Imaging, Department of Electrical Engineering, Technical University of Denmark, Kgs. Lyngby, Denmark. K. L. Gammelmark is now with Dako Denmark A/S, Glostrup, Denmark.